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Newport Natural History Society

From J. M. K. Southwick

State of Rhode Island and Providence Plantations.

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ANNUAL REPORT

OF THE

COMMISSIONERS OF INLAND FISHERIES,

MADE TO THE

GENERAL ASSEMBLY

AT ITS

JANUARY SESSION, 1891.

PROVIDENCE, R. I.
E. L. FREEMAN & SON, PRINTERS TO THE STATE.
1891.

REPORT.

To the Honorable the General Assembly of the State of Rhode Island and Providence Plantations, at its January Session, 1891:

The Commissioners of Inland Fisheries herewith present their annual report for the year 1890.

TROUT.

40,000 eyed brook trout eggs were purchased by us. These were successfully hatched by Mr. Charles A. Hoxie of Carolina.

The same plan as pursued by us last season, of keeping the trout fry in artificial ponds during the warm weather, placing them in the streams as late as December, was followed this season with very gratifying results. The fry in the early part of December are from four to eight inches in length, and able to look for themselves. We were able to supply all applicants, and not a fish was lost in transportation.

It is remarked by all who are conversant with the streams of our State, that the increase of brook trout has been remarkable.

The past two or three seasons have been favorable for re-stocking the streams, and the results have exceeded our expectations.

LAND-LOCKED SALMON.

Colonel McDonald, United States Fish Commissioner, gave us ten thousand land-locked salmon eggs. From these in December we had upwards of four thousand fry averaging over five inches in length.

These were placed in our deepest ponds without any loss. There is no doubt in our minds of our being able to, within four years, having a satisfactory showing in many of our ponds of this, the king of all inland fishes. Repeated efforts of stocking with small fry have proved futile.

BLACK BASS.

This fine, as well as game fish, is increasing in our waters and gaining popularity as an edible fish. Some large catches have been reported to us.

GOLD FISH.

Colonel McDonald also presented us with about four thousand gold fish, differing in variety, taken from the Government ponds.

These were given to several cemeteries, Butler Hospital and Roger Williams Park.

BAY AND SHORE FISHERIES.

The fishing in the waters of the upper part of the bay has run very good the past season. Tautog and scup quite plenty; small sand scup having been taken very plentifully at Pawtuxet, and all the shore resorts. Small mackerel (tinkers) have also been caught at Bower's Cove and at India Point wharves,—something heretofore quite unknown to the commissioners, if not to older fishermen.

THE SEINE FISHERIES.

This branch of industry has not been so remunerative as in some other seasons, owing to unfavorable weather and the very low prices obtained. The traps as a rule have not done well. The sportsmen have had all they wanted of small scup, and little mackerel, while the larger game, as bass, blue-fish and tautog, have not been wanting, and the hook and liner has been well rewarded by large catches.

The most notable feature of the fish business this year has been the extremely low prices, and abundant supply throughout the entire season.

SCUP.

These fish were not plenty in the spring, and the weather was not favorable to a large catch. The catch in the traps commenced on 27th of April and continued to the 23rd of May. The total catch at Coggeshall's Point was 7,500 barrels; all others about 1,600 barrels; total, 9,100 barrels.

The large scup were very scattering in the bay, but from the first of May small scup appeared in immense numbers, but very small, it taking twenty to weigh one pound. They came into all parts of the bay and were caught everywhere during the summer.

In the early fall they were still plenty and six of them would weigh one pound, showing the season's growth.

On the 4th of May codfish were very abundant. From one of them twenty-seven scup were taken.

The run of fish this season was about two weeks earlier than last.

Captain N. B. Church, to whom we are indebted for much valuable information and who has kindly allowed us the use of his journal, records that "The number of codfish caught in traps was unprecedented; sometimes a ton were taken at one haul. That he saw more squeteague, blue-fish and sea-bass than ever before in all his experience. The blue-fish were observed the whole length of the coast, from Barnegatt, N. J., to Sequin Island, Maine.

"The squeteague were plenty in Seaconnet River for about six weeks, beginning to run, I think, about the middle of June. They were so plenty that the people made but little exertion of catching them, as they would not bring enough in the market to more than pay the shipping bills. The same is true with the blue-fish.

"That the blue-fish ruined the menhaden fishing in this section."

The following table shows the amount of fish and lobsters sent by way of Old Colony Steamboat and Railroad Lines from Newport, for each month in the year 1890:

	Fish.	Lobsters.
January	56 barrels	148 boxes.
February	36 "	118 "
March	48 "	147 "
April	861 "	235 "
May	5851 "	224 "
June	506 "	419 "
July	339 "	576 "
August	84 "	507 "
September	342 "	136 "
October	487 "	27 "
November	304 "	50 "
December	19 "	63 "
	8933 "	2650 "
To this must be added the amount shipped in fish steamers	3345 "	
Making total of fish	12,278 "	

These figures do not include all the fish shipped. Quite a number of barrels were sent to Providence; besides, we have no account of what went over the Stonington Road.

From one-half to three-fifths of these fish are scup; the balance comprise all the varieties of edible fish found in our waters.

MACKEREL

Have not favored us with their presence in large numbers.

September 23d they put in their appearance and several hundred barrels were taken; but they soon left us under sealed orders, as suddenly as they came, while their smaller relatives, the "little mackerel," remained with us in good numbers for a long time.

HORSE MACKEREL.

The late Professor S. F. Baird, in his report for 1871 and 1872, under the head of "Natural History of Important Food Fishes," gives us a very valuable paper upon this fish. And it is so replete with in-

valuable practical, as well as historical facts, that we feel justified in giving it in full:

"THE BLUE-FISH."

Pomatomus Saltatrix.

Names.—This fish, which on the coast of New England and the Middle States is called the blue-fish, is also known in Rhode Island as the "horse mackerel"; south of Cape Hatteras as the "skipjack"; in North Carolina, Virginia, and Maryland it is said to be called the "green-fish." Young blue-fish are in some parts of New England called "snapping mackerel" or "snappers"; about New Bedford, "blue snappers"; to distinguish them from the sea bass they are sometimes spoken of as the "blue-fish." About New York they are called "skip mackerel," and higher up the Hudson River "white-fish."

In the Gulf of Mexico the name "blue-fish" is in general use.

Distribution.—This species is widely distributed — in the Malay Archipelago, Australia, at the Cape of Good Hope, at Natal and about Madagascar; in the Mediterranean, where it is a well-known and highly prized food fish in the markets of Algiers, though rare on the Italian side. It has been seen at Malta, at Alexandria, and on the coast of Syria, and about the Canaries. It has never been seen on the Atlantic coast of Europe, and, strangely enough, never in the waters of the Bermudas or any of the Western Islands. On our coast it ranges from Central Brazil and the Guianas through the Gulf of Mexico and north to Nova Scotia, though never seen in the Bay of Fundy. From Cape Florida to Penobscot Bay, blue-fish are abundant at all seasons when the temperature of the water is propitious. It is not known yet what limits of temperature are the most favorable to their welfare, but it would appear, from the study of the dates of their appearance during a period of years in connection with the ocean temperature, that they prefer to avoid water which is much colder than 40°. It is possible that the presence of their favorite food, the men-

haden, has as much influence upon their movements as water temperature.

It is certain that few blue-fish are found on our Middle and Southern coast when the menhaden are absent; on the other hand, the blue-fish do not venture in great numbers into the Gulf of Main at the time when menhaden are schooling and are at their greatest abundance. Their favorite summer haunts are in the partially protected waters of the Middle States, from May to October, with an average temperature of 60° to 75°. The menhaden, or certain schools of them, affect a cooler climate and thrive in the waters of Western and Central Maine in the months when the harbor temperatures are little above 50° and 55°, and that of the ocean considerably lower."

Professor Baird has published in the First Report of the United States Fish Commission an exhaustive account of the habits of the blue-fish which will be quoted from freely in this chapter.

The presence of quotation marks will be sufficient to indicate the source of the paragraphs taken from his essay, without further reference to his name.

"*Movements and Migrations.*—The blue-fish is preeminently a pelagic or wandering fish, and like many others, especially of the *scrombridæ*, is apparently capricious in its movements, varying in numbers at particular localities with the year, and sometimes disappearing from certain regions for a large fraction of a century, again to return as before. The cause of this variation it is impossible to explain, being due in some instances, probably, to the disappearance of its favorite food in consequence of its own voracity, or for other undetermined reasons.

"They occur during the summer throughout the entire range indicated for the United States, but are much larger in size and in greater abundance from the coast of New Jersey northward. From New Jersey southward, in the season mentioned, with the exception of an occasional wandering school, they are generally only about eight to twelve inches in length, representing, therefore, in all probability, individuals of the second year's growth.

"They appear to have a regular migration along our coast, presenting themselves later and later in the spring, the farther they are found to the north, and disappearing in the inverse order from the same regions in the autumn. First noticed on the Carolina coast as early as March and April, immense schools of them, bound eastward, are seen off the coast of the Middle States from the middle of May to the middle of June,[1] and in October similar bodies, perhaps embracing fewer individuals, pass to the southward. It is possible, however, that in the autumn some schools move well out to sea, and are, therefore, less likely to be observed. They leave the northern coast about the middle of October, and about the middle of November appear in vast numbers off the coast of North Carolina, where, from Nag's Head, in Currituck County, to Cape Lookout, there is a very extensive fishery prosecuted, which furnishes blue-fish for the northern markets. It is estimated that at least one hundred and fifty crews are engaged in this fall fishing, which lasts generally until late in December. At this time individuals may be taken weighing fifteen to eighteen pounds, although their average size is about ten.

"Their occurrence in autumn off the coast of North Carolina is preceded and first indicated by the vast schools of menhaden, which they follow in, several miles from the sea, and by the usual accompaniment of flocks of gulls attending them to take a share in the feast. Of the particular mode of fishing in this neighborhood we shall take occasion to speak hereafter.

"According to Dr. Yarrow the blue-fish are seen in spring on the North Carolina coast (the smaller ones first) in March or April, when, however, they are much less in size than the specimens referred to as occurring in the fall. The precise time of their appearance at most of the points farther north has not yet been ascertained. Whether they actually migrate from south to north, and *vice versa*, or merely come in from the outer seas in regular order, as is believed to be the case

[1] In the Chesapeake, according to Dr. Wilkins, at Hunger's Wharf, Virginia, the tayler is one of the most abundant fish, as many as four thousand being caught at one lift of the pound. The average size is about three pounds. They come about the first of June and leave early in October.

with the shad, etc., has not been settled, although the former supposition appears the most probable. They reach the New Jersey coast sometime in the early part of May, and usually appear at Newport and in Vineyard Sound (the time varying with the season) from the middle of May to the first week in June. They are expected at Edgartown from the 25th to the 30th of May; but I am informed that, on their first arrival they feed at the bottom, and sometimes for a while are not seen at the surface at all, seldom being taken with the hook, but caught in large numbers in pounds and with gill-net, usually along the lower edge of the net. According to Dr. Yarrow, they are not taken with the hook about Beaufort until about the 1st of July.

They do not bite, however, in Vineyard Sound until from the 10th to the 15th of June, when they appear on the surface, and are caught in large numbers in the usual manner."

In the first week of May, 1878, about a thousand blue-fish, weighing four pounds each, were caught off Long Island at Canarsie and West Hampton. This is about two months earlier than is usual for them to be taken in any considerable numbers.

"*Periodicity.*—Great interest attaches to this fish in consequence of the changes in its abundance, and even its actual occurrence on our coast, within the historic period. The precise nature and extent of the variation has not been established, nor whether it extended along the entire coast or not. Its earliest mention for our waters is in the work of Josselyn ('New England Rarities Displayed,' 1672,) where, on page 96, he mentions the 'blew-fish, or horse,' as being common in New England (his residence was on the New Hampshire coast, or near by in Maine,) and 'esteemed the best sort of fish next to rock-cod.' He says: 'It is usually as big as the salmon, and a better meat by far.' He also, on page 24, catalogues two kinds of 'blew-fish' or 'hound-fish'; the 'speckeled hound-fish' and the 'blew hound-fish, called horse-fish.'

"There appears no species to which this reference could apply except the subject of our present article, this being the opinion of Mr. J. Ham-

mond Trumbull, who has devoted much research to determining the modern equivalents of ancient Indian names of animals, and to whom I am indebted for the hint. Mr. Trumbull also remarks that in a manuscript vocabulary obtained by President Stiles, in 1762, from a Pequod Indian at Groton, Connecticut, there is mentioned the 'Aquaundunt or blue-fish,' clearly the same as what now bears that name, which shows that this fish was found in Fisher's Island Sound in 1762.

"Again, according to Zaccheus Macy[1], the blue-fish were very abundant about Nantucket from the first settlement of the English on the island, in 1659 to 1763, and were taken in immense numbers from the 1st of June to the middle of September. They all disappeared however in 1764, a period of great mortality among the Indians of that island. It has been suggested that the disease which attacked the Indians may have been in consequence of an epidemic in the fish upon which they fed, or else that it invaded both fish and Indians simultaneously, resulting in almost their entire extermination.[2]

"According to Dr. Mitchell, this fish was entirely unknown about New York prior to 1810; but they began to be taken in small numbers about the wharves in 1817, and were abundant in 1825.

Immense numbers were caught at the Highlands in 1841. The doctor remarks, as has been done repeatedly by others, that as the blue-fish increase, the squeteague or weak-fish diminished in about the same ratio.

"According to Mr. Smith, of Newport (Rhode Island), his father used to catch blue-fish some time about the year 1800, when they were abundant and of large size, weighing from sixteen to eighteen pounds.

"Captain Francis Pease, of Edgartown, also testified that his father spoke of large blue-fish at the end of the preceding century, some of them weighing forty pounds. This leaves an interval between 1764

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[1] Collections Massachusetts Historical Society for 1794, iii., 1810.

[2] "From the first coming of the English to Nantucket (1659) a large fal-fish, called the blue-fish, thirty of which would fill a barrel, was caught in great plenty all round the island from the first of the sixth month (June) till the middle of the ninth month (September). But it is remarkable that in the year 1764 . . . they all disappeared, and that none have ever been taken since. This has been a great loss to us."—Ibid., 1792, p. 159. Zaccheus Macy's Account of Nantucket.

and toward the end of the century in which no mention is made of the blue-fish, and which may probably indicate its absence, as during that time there were many works published relating to the local history and domestic economy of New England, and which would doubtless have taken note of so conspicuous a fish had it been present.

"Whether they existed uninterruptedly during the century intervening between Josselyn's time 1672 (or even 1659, according to Macy) and 1764, I am at present unable to say. According to Captain Pease, they were known about Edgartown at the end of the last century.[1] As already stated, Mr. Mitchell speaks of their first making their appearance in New York about 1810. They are noted as having been seen in Vineyard Sound again as early as 1820. It would therefore appear that they were in such small numbers about New York in 1810 that the young only were noticed flocking about the wharves, and that in ten years they were observed as far east as Nantucket, where the specimens seen from 1824 to 1826 were very small, not over four inches. The next year they measured seven and the third year ten inches, according to the testimony of one witness, although this does not represent, in all probability, the rate of growth.

"According to Captain Burgess, of Monument, Massachusetts, they were caught about Nantucket in 1825, and were very abundant in 1830. Dr. Storer states the first blue-fish recorded as having been noticed in the present century north of Cape Cod was captured on the 25th of October, 1837. Captain Atwood remarks that in 1838 he saw blue-fish for the first time about Provincetown. These were very small, the largest weighing only two pounds. In a few years, however, they became larger and more numerous, and finally increased to such an extent as to exercise a very marked influence upon the fisheries. According to the captain (Proceedings of Boston Society of Natural History,

[1] President Dwight bears witness to the fact that blue-fish were abundant in the Narragansett Bay region as late as 1780. "The mackerel formerly frequented this coast in immense numbers, and in the season were constantly to be found in the market. But about the close of the Revolutionary War they forsook our waters and have not made their appearance since. They were esteemed a great delicacy, and are the largest of the mackerel species."—Note on Fishes of Newport, Rhode Island. Dwight's Travels, iii., 1822, p. 50.

1863, p. 189,) they arrive in Massachusetts Bay in a body, coming at once, so as to almost fill the harbor at Provincetown. In one year they came in on the 22d of June, and although the day before eight thousand mackerel were taken, the day after not one was seen or captured.

He says that they leave about the last of September, with the first cold northeasterly storm, although stragglers are taken as late as December at Provincetown.

"According to Messrs. Marchant and Peter Sinclair, of Gloucester, (October, 1872,) blue-fish made their first appearance in numbers about Cape Ann twenty-five years ago, coming in great force and driving out all other fish. They are now scarcer than twenty years ago; about the same as tautog; some seasons scarcely noticed.

"Mr. J. C. Parker, an aged gentleman of Falmouth, says the first blue-fish seen at Wood's Holl in this century was taken in July, 1831; but his father informed him that they were abundant in the preceding century, about 1780 or 1790, at which time they disappeared; and that when the blue-fish left, the scup first made their appearance. They are also noted as having shown themselves at the head of Buzzard's Bay in 1830 and 1831, and, although numerous, were of small size, measing about a foot in length.

"To sum up the evidence, therefore, in regard to the periodical appearance of the blue-fish, we find notice of its occurrence in 1672, or even 1659, and up to 1764. How long it existed in the waters prior to that date cannot now be determined. The oral testimony of Mr. Parker refers to its occurrence at Wood's Holl in 1780 or 1790; and it is mentioned by Mr. Smith as being at Newport in 1800, and at Edgartown, Massachusetts, about the same time by Captain Pease. Mitchell testifies to its occurrence in New York, of very small size, in 1810; and it is recorded as existing again at Nantucket in 1820, and about Wood's Holl and Buzzard's Bay in 1830 to 1831; and a little later at Hyannis.

In 1830 it had become abundant about Nantucket, and in the fall of 1837 it was first noticed in Massachusetts Bay; and then year by year

it became more and more numerous, until now it is very abundant. Several accounts agree in reference to the very large size (even to forty or fifty pounds) of those taken in the last century.

"Further research into ancient records may tend to throw more light on the early history of the blue-fish, and even materially to change the conclusions already reached. It will be observed that the references to its occurrence, from 1780 to 1800, are on the testimony of aged persons who have heard their fathers speak of it, although I find no printed records anywhere in reference to it between 1764 and 1810. The rate of progression to the north of Cape Cod I have at present no means of indicating, although they probably gradually extended farther and farther north, and may possibly occur much farther east than we have any mention of at present.

"During the present century the maximum of abundance of these fish off the middle coast of the United States appears to have been reached from 1850 to 1860. The testimony elicited from various parties, as well as from printed records, indicates a decrease since that period much greater in some localities than others. About New York they are said to have been unusually plenty in the summer of 1871, but farther East the diminution which had been observed in previous years appeared to continue."

Since the writing of the above, in 1871, there has been no special change in the abundance of blue-fish. They are quite sufficient in number to supply the demand for them and to make great inroads upon the other fishes, some of which, like the menhaden and mackerel, would perhaps, if undisturbed by the blue-fish, be more valuable than they are at present. They have now been with us for fifty years. Their numbers are subject to periodical variation, of the cause of which we are ignorant. It is to be regretted that there are no records of it in the South Atlantic States. If such existed, we might, perhaps, learn from them that the blue-fish remained in those waters while absent from the northern coasts. Only one statement is to be found which covers this period, although Lawson, in his "History of North Carolina," published in 1709, and Gatesby, in his "Natural History

of the Carolinas," published in 1743, refer to its presence. In "Bertram's Travels," published in 1791, "skipjack" is mentioned as one of the most abundant fish at the mouth of the St. John's River.

When blue-fish again became abundant their presence was first noticed at the South, and they seem to have made their inroads from that direction. The blue-fish was unknown to Schoepf, if we may judge from his work on the "Fisheries of New York," published in 1787. Dr. Mitchell recorded their frequent capture about New York in 1814, though before 1810 they are said to be unknown in that locality. In 1825 they were abundant here, and in 1841 immense numbers were captured in the Vineyard Sound, and about Nantucket they were on the increase from 1820 to 1830. It is certain that they had not reappeared in 1822 in Narragansett Bay, for in "Bertram's Travels" it is stated that, though formerly abundant, they had not been seen in that region since the time of the Revolution.

The first one which was noticed north of Cape Cod was captured in October, 1837, while we have no record of their appearance about Cape Ann before 1847.

Food and Voracity.—The blue-fish is a carniverous animal of the most pronounced type, feeding solely upon other fish. In this connection it cannot be out of place to reprint Professor Baird's remarks upon this subject, which have been so often quoted during the past ten years:

"There is no parallel in point of destructiveness to the blue-fish among the marine species on our coast, whatever may be the case among some of the carniverous fish of the South American waters. The blue-fish has been well likened to an animated chopping machine, the business of which is to cut to pieces and otherwise destroy as many fish as possible in a given space of time.

All writers are unanimous in regard to the destructiveness of the blue-fish. Going in large schools, in pursuit of fish not much inferior to themselves in size, they move along like a pack of hungry wolves, destroying everything before them. Their trail is marked by fragments of fish and by the stain of blood in the sea, as, where the fish is too large to be swallowed entire, the hinder portion will be bitten off

and the anterior part allowed to float away or sink. It is even maintained, with great earnestness that such is the gluttony of the fish, that when the stomach becomes full the contents are disgorged and then again filled. It is certain that it kills many more fish than it requires for its own support.

"The youngest fish equally with the older, perform this function of destruction, and although they occasionally devour crabs, worms, etc., the bulk of their sustenance throughout the greater part of the year is derived from other fish. Nothing is more common than to find a small blue-fish of six or eight inches in length under a school of minnows making continual dashes and captures among them. The stomachs of the blue-fish of all sizes, with rare exceptions, are found loaded with the other fish, sometimes to the number of thirty or forty, either entire or in fragments.

"As already referred to, it must also be borne in mind that it is not merely the small fry that are thus devoured, and which it is expected will fall a prey to other animals, but that the food of the blue-fish consists very largely of individuals which have already passed a large percentage of the chances against their attaining maturity, many of them, indeed, having arrived at the period of spawning. To make the case more clear, let us realize for a moment the number of blue-fish that exist on our coast in the summer season. As far as I can ascertain by the statistics obtained at the fishing stations on the New England coast, as also from the records of the New York markets, kindly furnished by Middleton & Carman, of the Fulton Market, the capture of blue-fish, from New Jersey to Monomoy, during the season, amounts to not less than one million individuals, averaging five or six pounds each. Those, however, who have seen the blue-fish in his native waters, and realized the immense number there existing, will be quite willing to admit that probably not one fish in a thousand is ever taken by man. If, therefore, we have an actual capture of one million, we may allow one thousand million as occurring in the extent of our coasts referred to, even neglecting the smaller ones, which, perhaps, should also be taken into the account.

"An allowance of ten fish per day to each blue-fish is not excessive, according to the testimony elicited from the fishermen, and substantiated by the stomachs of those examined; this gives ten thousand millions of fish destroyed per day. And as the period of the stay of the blue-fish on the New England coast is at least one hundred and twenty days, we have in round numbers twelve hundred million millions of fish devoured in the course of a season.

"Again, if each blue-fish, averaging five pounds, devours or destroys even half its own weight of other fish per day (and I am not sure that the estimate of some witnesses of twice this weight is not more nearly correct), we will have, during the same period, a daily loss of twenty-five hundred million pounds, equal to three hundred thousand millions for the season.

"This estimate applies to three or four year old fish, of at least three to five pounds in weight. We must, however, allow for those of smaller size, and a hundred fold or more in number, all engaged simultaneously in the butchery referred to.

"We can scarcely conceive of a number so vast; and however much we may diminish, within reason, the estimate of the number of blue-fish and the average of their captures, there still remains an appalling aggregate of destruction. While the smallest blue-fish feed upon the diminutive fry, those of which we have taken account capture fish of large size, many of them if not capable of reproduction, being within at least one or two years of that period.

"It is estimated by very good authority that of the spawn deposited by any fish at a given time not more than thirty per cent. are hatched, and that less than ten per cent. attain an age when they are able to take care of themselves. As their age increases, the chances of reaching maturity become greater and greater. It is among the small residuum of this class that the agency of the blue-fish is exercised, and whatever reasonable reduction may be made in our estimate, we cannot doubt that they exert a material influence.

"The rate of growth of the blue-fish is also an evidence of the immense amount of food they must consume. The young fish which

first appear along the shores of Vineyard Sound, about the middle of August, are about five inches in length. By the beginning of September, however, they have reached six or seven inches, and on their reappearance in the second year they measure about twelve or fifteen inches. After this they increase in a still more rapid ratio. A fish which passes eastward from Vineyard Sound in the spring, weighing five pounds, is represented, according to the general impression, by the ten to fifteen pound fish of the autumn.

If this be the fact, the fish of three or four pounds which pass along the coast of North Carolina in March return to it in October weighing ten to fifteen pounds.

"As already explained, the relationship of these fish to the other inhabitants of the sea is that of an unmitigated butcher; and it is able to contend successfully with any other species not superior to itself in size. It is not known whether an entire school ever unite in an attack upon a particular object of prey, as is said to be the case with the ferocious fishes of the South American rivers; should they do so, no animal however large, could withstand their onslaught.

"They appear to eat anything that swims of suitable size—fish of all kinds, but perhaps more especially the menhaden, which they seem to follow along the coast, and which they attack with such ferocity as to drive them on the shore, where they are sometimes pilled up in windrows to the depth of a foot or more.

"The amount of food they destroy, even if the whole of it be not actually consmmed, is almost incredible. Mr. Westgate (page 33) estimates it at twice the weight of the fish a day, and this is perhaps quite reasonable. Captain Spindle goes so far as to say that it will destroy a thousand fish a day. This gentleman is also of the opinion that they do much more harm to the fishes of the coast than is caused by the pounds. They will generally swallow a fish of a very large size in proportion to their own, sometimes taking it down bodily; at others, only the posterior half. The peculiar armor of certain fish prevents their being taken entire; and it is not uncommon to find the head of a sculpin or other fish, whose body has evidently been cut off

by the blue-fish. In the summer time the young are quite apt to establish themselves singly in a favorite locality, and, indeed, to accompany the fry of other fishes, usually playing below them, and every now and then darting upward and capturing an unlucky individual, while the rest dash away in every direction. In this manner they attend upon the young mullet, atherinas, etc. They are very fond of squid, which may very frequently be detected in their stomachs.

In August, 1870, about Fire Island, Mr. S. I. Smith found their stomachs filled with marine worms, a species of heteronereis, which, though usually burrowing in the mud, at that season swims freely toward the surface in connection with the operation of reproduction. This, like the squid, is a favorite bait for the bluefish, and they appear to care for little else when these are to be had. This fact probably explains the reason why, at certain seasons, no matter how abundant the fish may be, they cannot be taken with the drail or squid bait."[1]

The blue-fish are believed to have had a very important influence upon the abundance of other species on some parts of the coast. This has been noticed especially on the north side of Cape Cod. South of Cape Cod the small fish occur in such numerous abundance that even the voracity of millions of blue-fish could hardly produce any effect upon them. Captain Atwood has recorded his belief that the advent

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[1] The following extract from the "Gloucester Telegraph" of June 4, 1870, gives an idea of their influence upon other fishes:

"ABUNDANCE OF FISH IN NEW JERSEY—1870.—Accounts from New Jersey say that the blue-fish came in at Barnegat Inlet last week, sweeping through the bay, over flats as well as through the channel, driving millions of bushels of bunkers before them and filling the coves, creeks, ditches and ponds in the meadows full. At Little Egg Harbor Inlet they drove shad on shore so that people gathered them up by wagon-loads. Fish lie in creeks, ponds, etc., along the meadows two feet deep, so that one can take a common fork and pitch them into a boat or throw them on the bank. In some places they lie in windrows on the meadows where the tide has taken them, so they take large wood-scows alongside and load them."

1857.—"Blue-fish were very plenty off our shores in the early part of autumn. They are great enemies to the menhaden; and for several days such a war raged that the beaches were strewn with dead fish, chiefly of the latter species. Mr. Lewis, the historian, said that in two tides he picked up nine bushels and buried them in his garden for manure."—Lewis and Newhall, p. 452, History of Lynn.

of the blue-fish drove away the plaice or large flounder from those waters, not so much by their direct attacks upon them as by destroying the squid upon which the latter formerly subsisted. He is also of the opinion that the mackerel once, for a time, were affected by them. The mackerel have since returned to those waters in their wonted numbers, but the blue-fish are not sufficiently plenty north of Cape Cod to interfere with them. The flight of the mackerel was not an unmitigated evil, however, since as Captain Atwood pointed out, the number of lobsters for a time was very considerably increased. The mackerel fed upon their eggs, and when they were driven away by the blue-fish the lobsters had a better chance to multiply.

"The blue-fish sometimes make their way up the rivers to a considerable distance, the adults, however, apparently never entering the perfectly fresh water. They are found in the Potomac as far north as Aquia Creek, and also far up the Hudson; indeed, the young of the year are taken as high as Sing Sing on the Hudson, and other tidal rivers, where the water is entirely fresh."

Reproduction.—"Little is known of their reproduction. Dr. Yarrow does not give any facts in regard to this subject, at Fort Macon, except that spawn was seen to run out of a small female caught July 14. Dr. Holbrook is also silent on this head.

Mr. Genio C. Scott, says the spawning beds are visited by the parent in June, and consist of quiet nooks or bays. Mr. R. B. Roosevelt states that very diminutive young occur in immense numbers along the coast at the end of September or beginning of October ('Game Fish of America,' 1862, 159). I found the young fish at Carson's Inlet, Beasley's Point, New Jersey, 1854, two or three inches in length, and more compressed than the adult; but farther east, on Vineyard Sound, although diligent search was conducted between the middle of June and the first of October, with most efficient apparatus in the way of fine-meshed nets, I met with nothing excepting fish that made their appearance all at once along the edge of the bay and harbor.

"According to Captain Edwards, of Wood's Holl, a very accurate observer, they have no spawn in them when in Vineyard Sound. This

statement is corroborated by Captain Hinckley; and Captain Hallet, of Hyannis, 'does not know where they spawn.' The only positive evidence on this subject is that of Captain Pease, who states it as the general impression about Edgartown that they spawn about the last of July or the first of August. He has seen them when he thought they were spawning on the sand, having caught them a short time before, full of spawn, and finding them afterwards for a time thin and weak. He thinks their spawning ground is on the white sandy bottom to the eastward of Martha's Vineyard, toward Muskeegut. While not discrediting the statement of Mr. Pease, it seems a little remarkable that so few persons on the eastern coast have noticed the spawning in the summer of the blue-fish; and although there may be exceptions to the fact, it is not impossible that the spawning ground is in very early spring, or even in winter, off New Jersey and Long Island or farther south. It is not impossible that, at a suitable period after spawning, the young, in obedience to their migratory instinct may move northward along the coast, growing rapidly as they proceed. This explains the almost sudden appearance of fish of five inches about Wood's Holl.

"We have the statement of Dr. Yarrow that vast schools of small blue-fish were met in Beaufort Harbor during the last week in December, 1871. These were in company with small schools of young menhaden and yellow-tail shad, and were apparently working their way toward the sea by the route of the inlet. When observed they were coming from the southward through the sound, moving very slowly, at times nearly leaving it, and then returning.

The largest were about four inches in length, and others were much smaller; and as many as twenty schools were observed from the wharf at Fort Macon, each of them occupying an area of from sixty to eighty feet square, and apparently from four to six feet in depth. I would not be much surprised if these fish should prove to have been spawned late in the year off the southern coast."

Dilligent search by numerous inquirers during a period of ten years has failed to add anything of importance to what Professor Baird has already stated in the paragraph above quoted, and it may be regarded

as almost certain that blue-fish do not spawn in our inshore waters. The only important contribution to our knowledge on this subject is found in the notes of Mr. Silas Stearns, who believes that he has abundant evidence of their spawning in the Gulf of Mexico. His remarks are quoted in full below. The Hon. Robert B. Roosevelt records that he observed the blue-fish fry less than an inch in length in the inlet of Far Rockaway, New York, on the 10th of July.

Size.—"The size varies considerably with season and locality, those spending the summer on the southern coast, according to good authority, rarely exceeding two or three pounds in weight, and being generally considerably less. The largest summer specimens are those found farther to the eastward, where they are not unfrequently met with weighing from ten to fifteen pounds, although this latter weight is quite unusual. Mr. Snow, however, (page 44) mentions having seen one of twenty-two pounds, and others give as their maximum from fourteen to twenty. The average size of the schools in Vineyard Sound, during the early season, is from five to seven pounds. The schools, however, that make their appearance in October embrace many individuals of from ten to fifteen pounds.

It is, therefore, not improbable that the difference between the first mentioned average and the last represents the increase by their summer feeding. As already remarked, blue-fish in the last century sometimes attained a weight of forty or fifty pounds in Vineyard Sound; according to Zaccheus Macy, thirty of them would fill a barrel."

"Forest and Stream," June 25, 1874, states that L. Hathaway, Esq., a veteran fisherman, while fishing from the bridge at Cohasset Narrows, Massachusetts, with rod and reel, captured a blue-fish weighing twenty-five pounds. The largest previously caught weighed seventeen pounds.

"On getting back to the Carolina coast in the early part of November, according to Dr. Yarrow's statement, they are from three to five feet in length and weigh from ten to twenty pounds. What becomes of these large fish, that so few of them are seen in the early spring, it is impossible to say. If it be really true that they are much scarcer

than in the fall, we may infer that their increased size makes them a more ready prey to the larger fish and cetaceans, or that they have accomplished their ordinary period of life; possibly that they have broken up into smaller parties, less conspicuous to observation, or that they have materially changed their locality. The average length of the fish that appear in the spring off the coast of Virginia and the southern part of New Jersey, according to Dr. Coues, Dr. Yarrow, and my own observation, is about one foot, being probably about one year old.

As a general rule, those of the smaller size keep close to the shore and can always be met with, while the larger ones go in schools and remain farther outside.

"I was unable to obtain any very young fish about Wood's Holl in 1871, the smallest found making their appearance quite suddenly along the coast, especially in the little bays, about the middle of August, and then measuring about five by one and one-fifth inches. By the end of a year they probably constitute the twelve or fifteen inch fish referred to as occurring along the southern coast. The fish of the third year, or those two years old, are possibly the three-pound fish, while the five to seven pound fish may be considered a year older still. Accurate observations are wanting, however, to determine these facts; as also whether they require two years, or three or more, to obtain sufficient maturity for breeding. As far as I know, there is no appreciable difference between the sexes in their rate of growth or weight, excepting that the female is likely to be a little deeper in the body."

A blue-fish weighing one pound measures about fourteen inches; two pounds, seventeen inches; three pounds, twenty-one inches; four pounds, twenty-four inches; five pounds, twenty-six inches; six pounds, twenty-six to twenty-seven inches, and eight pounds, twenty-nine inches.

Stearns on Blue-fish in the Gulf of Mexico.—Mr. Stearns' notes on the occurrence of the blue-fish in the Gulf of Mexico are so important that they are quoted in full:

"The blue-fish is abundant in West Florida and as far west as the Mississippi river, but is rare or not found at all in other parts of the Gulf. At Pensacola and vicinity it is at certain seasons one of the most important fishes of trade. Here it is caught only in seines and when migrating, during the months of April, May, June, November and December. It usually appears on the coast in April—sometimes a little sooner—and comes from the northeast, swimming directly in from deep water, or parallel to the land, according to the condition of the sea. It sometimes swims near the surface, either to sport or prey upon smaller surface-swimming fishes, but more commonly at some depth in shoal water along the beach. Many schools are observed through the months of April, May and June approaching the land from the eastward, and it is supposed that there are several distinct 'runs' in that period. These 'runs' take place every year, although much larger some years than others. It is usually the case that the fish arriving in the spring are small, averaging two and a half pounds weight, and that those caught in the fall are larger, averaging four pounds or more. A few very large individuals are found in both seasons.

"In May and June blue-fish enter the bays. They remain for some days in the swift tideways when inside, and then disappear almost entirely from observation. A few are taken through the summer with hook and line in the bays and at sea. Excepting the smallest ones, all the blue-fish contain spawn when they arrive in the spring. With the larger fish the spawn is nearly ripe, and with the small and intermediate size is found in nearly all stages.

April 29, 1879, I examined two female blue-fish, weighing seven and eight pounds, and found spawn almost ripe enough to flow from the oviduct. The same day others, smaller ones, were examined, in which the ovaries were scarcely visible. The spawning season of the blue-fish includes several months, I think, which are May, June, July, and August.

"There can be no doubt of its spawning in the bays, sounds, and bayous, as all evidence gained goes so far to prove it. On June 18,

1878, and August 9, 1878, I caught young blue-fish of about three-quarters of an inch in length in Pensacola Bay. These fry were very active and gave me no little trouble in capturing them.

Their color was a brilliant green, which faded considerably when placed in alcohol. These, with others, were sent to the National Museum with my collections of that year. Many other specimens of about that size were seen in August, but escaped my net. During the months of November and December many small schools of blue-fish are seen to pass out of the inlets, and, if there is not much surf, to follow along the beach eastward. Blue-fish of all sizes may be seen at this time, the smaller ones measuring in length three to five inches, the intermediate sizes, ten, twelve, and fifteen inches, and the large ones from the last-mentioned size to a size weighing fifteen to eighteen pounds. Ten pounds is not an unusual weight for large blue-fish, but those of eighteen pounds are rare.

Blue-fish are said to be more abundant on this coast than formerly, and any change in the last five years has tended to an increase rather than a decrease. It is an exceedingly voracious fish, preying upon any kind of fish through which its teeth can cut and which its jaws can surround. I think its migratory movement on this coast is caused more on account of its food becoming scarcer in cold weather than on account of its being influenced by the change of the temperature of the water. For on the coldest days of the year (in December) blue-fish are sometimes caught in shoal water in great abundance as well as at any other time. The blue-fish is one of the choicest food fishes of this coast, and is much used, both fresh and salted."

Earll on the Blue-fish in North Carolina.—Below is given an outline of the winter blue-fish fisheries of the Southern coast as gathered from notes made during the visit of Mr. R. E. Earll to that region:

The large fish are taken in two localities—first, a few miles off Cape May, and again on the Carolina coast between Cape Henry and Ocracoke Inlet. They are most abundant between Cape Hatteras and New Inlet. Small fish frequently enter the sounds during the summer

months, and have long been taken by the residents. The larger ones seldom enter the inlets, but remain near the outer shore, where they feed upon the menhaden, shad and alewives, during the season of their migrations to and from the large sounds in fall and spring.

"Apparently, the first that was known of large blue-fish in this region was in 1842, when a quantity was taken in a haul-seine near New Inlet. Gill-nets were first used for the capture of the species in this locality in 1847, though they were not generally adopted till several years later. The first vessel visited the region in 1866, and from that date to 1879, six to twelve sails came regularly to that locality. The fishery reached its height between 1870 and 1876, when in addition to the vessels fully one hundred crews of five men each fished along the shores. The catch varies greatly from time to time, as the fish are constantly on the move and often go beyond reach of the seines and gill-nets.

Some seasons each boat's crew has averaged four or five thousand fish weighing ten to fifteen pounds each. And again they have taken almost nothing. Frequently the bulk of the catch of an entire season is taken in three or four days.

Since the winter of 1877 and 1878 the fish are said to have been much less abundant and of smaller size. In the winter of 1879 and 1880 about seventy-five crews were engaged in the fishery from the first of November till Christmas. The total catch did not exceed fifty thousand fish, averaging six pounds each. The small number taken is partially accounted for by the fact that many of the fish were so small as to readily pass through the meshes without being caught.

During my visit in May, 1880, large schools of blue-fish were reported along the shore, and a considerable number of shad and other species were found upon the beach where they had been driven by their pursuers. A good many blue-fish were also stranded while in pursuit of their prey. It seemed that there is no reason to believe that the fish have permanently left the coast, or that they are even so scarce as is at present claimed, for the men have fished with little regularity, and have gone only a short distance from the shore, while the bulk of the blue-fish may have been farther out.

Uses.—This is one of the most important of our food fishes, and surpassed in public estimation only by the Spanish mackerel and the pompano. It may be said to furnish a large part of the supply to the Middle and Northern States. It is a standard fish in New York, Boston and other seaports, and is carried in great numbers into the interior. Its flesh is very sweet and savory, but it does not keep very well. In the Vineyard Sound the fishermen are in the habit of crimping their fish, or killing them by cutting their throats in such a manner that they bleed freely. Everyone who has opportunities for observing admits that fish thus treated are far superior to any others. Great quantities of blue-fish are frozen in New York for winter consumption. They are still considered unfit for food on our Southern coast, and even in the markets of Washington, District of Columbia, I have frequently been stopped by fish-dealers who asked me to assure their customers that blue-fish were eatable. They are growing into favor everywhere, however, just as they did in Boston. Captain Atwood tells that in 1865 but very few were sold in Boston, and that the demand has been increasing ever since. When he first went to Boston with a load of blue-fish he got two cents a pound for them; the second year they were scarcer and he got two and one-half cents, and the year afterwards three cents."

These fish have the last season been plenty all along the coast, and, at times so very plenty that they have been sold as low as one cent a pound. An instance is reported to us where the captain of a smack declined a load offered as a gift, he having just left New York, where there was no market for them.

There has been good fishing all the season.

BASS.

The past season has been an exceptionally good one. If this fish has not been so plenty as at some former times, the fishing has been very good, and the sportsmen have made good catches. The fish have been large. We hear of two gentlemen who caught seven hundred

pounds in two days, and quite a number were taken ranging from forty to fifty-seven pounds.

TAUTOG.

There has been, we think, a very decided increase in this valued local fish, and reports come to us of good fishing for them in the fishing grounds in the bay.

HERRING

Did not appear as usual in the lower waters of the bay, but were plenty in the Taunton River. The traps that in years past caught thousands caught but very few.

FLAT-FISH.

These fish, that have usually been very plenty in Seaconnet river, failed to appear there in any considerable numbers; but we learn were plenty at Cole's river and other places.

MENHADEN.

These fish came to our coast about the middle of May in small schools, and the fishing was light all that month. In June they were here in large bodies and there was good fishing. Later on they moved eastward, and by the last of June were in Boston Bay.

From there the fishing was transferred to the coast of Maine until the last of September, when they again came south, and by the 21st of October were very plenty off our coast, but a heavy storm prevailed from the 23d to the 29th, after which none were to be found. They next appeared in immense schools off Barnegat, going south at the rate of one hundred miles a day.

The season closed about three weeks sooner than usual.

The catch of menhaden by our fleet was as follows:

Steamer G. W. Humphreys	60,000	barrels.
" A. M. Hathaway	49,000	"
" Joseph Church	45,000	"

Steamer George Curtis	45,000	barrels.
" Cora P. White	32,000	"
" Fannie Sprague	27,000	"
" Wm. Wells	19,000	"
" Seven Brothers	16,000	"
Schooner Antelope	18,000	"
Steamer Walter Adams	50,000	"
" Mabel Bird	53,000	"
" George Morse	40,000	"
" Seaconnnet	36,500	"
" Fearless	31,000	"
Schooner Dragonett	1,748	"
" Penekese	3,038	"
Steamer Kingfisher	32,000	"
Received at Oil Works from other sources	1,800	"
	560,086	"

CATCH OF MENHADEN.

1886	232,471	barrels.
1887	175,667	"
1888	377,607	"
1889	508,482	"
1890	560,086	"

As expressed by the Commissioners in their last report, it is their earnest desire to make the report a correct and comprehensive account of all the fisheries of this State, and it is hoped that all who can will render such aid as they may towards accomplishing this end.

A correct account of the catches or any unusual occurrence will be thankfully received and appreciated.

While the Commissioners will spare no pains to collect information relating to the fisheries, they must depend upon the aid and cooperation of fishermen and others for statistics and other interesting matter relating to this subject.

We cordially invite all who have had personal observation or experience of special interest to correspond with us, and thus greatly add to the value and interest of the report.

State of Rhode Island in account with Commissioners of Inland Fisheries.

1889.		Dr.	
Dec. 31.	To Balance due Commissioners		$14 12
1890.			
April 19.	" Freight and express, gold fish		6 30
28.	" Brook trout eggs		55 98
	" Hatching and raising trout and salmon		31 13
	" Express on salmon and trout eggs		5 35
Dec 31.	" Stationery, stamps, envelopes, etc		16 25
	" Cans to transfer fry		9 00
	" Travelling expenses of Commissioners and expense distributing salmon and trout fry		61 86
			$199 89
		Cr.	
	By cash from State Treasurer		$199 89

J. M. K. SOUTHWICK,
HENRY T. ROOT,
WILLIAM P. MORTON,
Commissioners of Inland Fisheries.